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A Study of Electric Utilities in the United States with Emphasis Upon Union Electric Xompany of St. Louis, Missouri

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A STUDY OF ELECTRIC UTILITIES IN THE UNITED STATES WITH EMPHASIS UPON UNION ELECTRIC COMPANY OF ST. LOUIS, MISSOURI

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Introduction

The purpose of this paper is to present an informative and coherent discussion relative to the electrical industry in the United States with special emphasis on the Union Electric Company of Missouri. This paper was not meant to be comprehensive, but to present those items in the opinion of the writer which would be interesting and useful to the reader.

The writer wishes to express his appreciation to Dr. Earl S. Dickerson, Professor of Business at Eastern Illinois University for his advice and encouragement before and during the writing, and many suggestions incorporated in the final form. Acknowledgement goes to my typist, critic, and patient wife for her long hours spent on this paper.

The <u>delimitations</u> of this paper

The omission of technical details made necessary by the complexities of the public utility field in the area of electricity.

A necessary condensation and omission of extraneous material due to the huge amount of information about the indsutry in print.

Outline and Contents

A STUDY OF ELECTRIC UTILITIES IN THE UNITED STATES WITH EMPHASIS UPON UNION ELECTRIC COMPANY OF ST. LOUIS, MISSOURI

The public utility concept

Public utilities can and have encompassed many types of business endeavor. Referring to various court decisions upon which is based the concept of public utilities, one author states that it would be just as easy to enumerate points of differences as points of agreement in our Supreme Court as to what constitutes a public utility.[1] E. W. Clemens uses an institutional approach feeling that public utility status may be accorded to, or withheld from, a particular endeavor because of the history, economy, organizations, and society codes prevalent at the time. The institutions of our economy old or new will be shaped to serve the conditions of an evolving society.[2]

It is generally recognized that public utilities comprise a special grouping of industries "affected with a public interest" and conducted under government regulation.[3] In the past a wide variety of industries has been accorded public utility status -- some of them being bridges, ferries, wharves and docks, grain elevators, stockyards, cotton gins, taxicabs, innkeepers, bakers, pawnbrokers, and peddlers. Yet other

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[1]Herman H. Trachsel, Public Utility Regulation (Chicago, 1947), p. 46.

[2]Eli Winston Clemens, Economics and Public Utilities (New York, 1950), pp. 5-11.

[3]"Public Utilities," Encyclopedia Britannica, 1962, XVIII, p. 744.

businesses seemingly "affected with a public interest" such as the sale of theater tickets, meat packing, ice manufacturing, and the sale of gasoline have been excluded.[4] The courts tend to look at each individual case and judge its status considering the time, area, and conditions of competition prevalent at the moment. This preference of the courts has in part been responsible for the variety of businesses included and excluded from regulation at various times.

The foundation of modern public utility regulation laid down by the Supreme Court was in Munn vs. Illinois in 1877.[5] Finding their legal precedent in an English law treatise written two centuries earlier the majority held that "from the police powers of the state--regulation may be imposed when it becomes necessary for the public good."[6] In the German Alliance Insurance Company Case the concept of "businesses affected with a public interest" was held to include fire insurance rates because the insurance was necessary to business activity, the cost was significant, and the purchaser was at a bargaining disadvantage.[7] There then followed a series of decisions tending to limit the application of the "public interest" concept. Wolf Packing Company vs. Kansas Court of Industrial Relations (1923) excluded the food

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[4]Trachsel, p. 46.

[5]Clemens, p. 14.

[6]Ibid, p. 15.

[7]Ibid, p. 16.

preparation industry; Tyson and Brothers vs. Banton (1927) excluded the sellers of theater tickets from regulation; and in New State Ice Company vs. Liebmann (1932) the ice business was held to be a private one not subject to regulations.[8] An important principle was laid down in Williams vs. Standard Oil Company in 1928. Here the court held "that a business does not become affected with a public interest 'merely because it is large or because the public are warranted in having a feeling of concern in respect of its maintenance.'"[9]

From these decisions and others like them there is a growing outline of those tests usually applied and given weight by the courts in deciding whether or not a business endeavor is to be considered as being affected with a public interest and regulated as a public utility. These tests include:

1. devotion of property to a public use
2. historical background
3. existence of a franchise
4. necessity and monopoly (which are fundamental to public utility status)
5. excessive competition
6. emergency (regulation during war time)
7. competition with regulated industries
8. conservation of national resources
9. the national interest in the welfare of the industry
10. the test of legislative discretion (will the courts uphold regulation of the industry and to what extent?)[10]

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[8]Ibid, pp. 16-19.

[9]Ibid, p. 18.

[10]Ibid, pp. 21-34.

Trachsel in his book "Public Utility Regulation" gives substantially the same tests for public utility status but enlarges some areas to include: stable demand, eminent domain, safety of investments and efficient service, service to all, and limitations on withdrawal from service.[11]

Today the main services commonly included in the public utility area are:

a. transportation (common carriers) such as railroads, highway transport, oil and gas pipeline, waterways, and airlines;
b. communications including telephone, telegraph, radio and television;
c. power, heat, and light-mainly the gas and electric industries;
d. community facilities for water, sanitation and irrigation.[12]

With this brief look at the historical and court applied concepts of public utilities in general this paper now focuses specifically on the electrical industry; its founding, growth, and regulation in our economy.

History of electric utilities

The introduction in the 1870's of electricity as a source of light and power was undoubtedly the technological innovation which had the most revolutionary effect upon industry and the lives of the urban masses in the industrial centers of the nation.[13] In 1878 a Russian, Paul Jablochkov had lighted sixty-four electric candles for the Paris

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[11]Trachsel, pp. 48-49.

[12]"Public Utilities," p. 744.

[13]T. Harry Williams and others, A History Of The United States (Since 1865), (New York, 1961), p. 37.

Exposition in France. A friend of Thomas A. Edison, G. P. Lowry, discussed with Edison the possibility of improving on the Russians invention. Edison felt he could do it and in October, 1878, the Edison Electric Light Company was formed.[14] This was the beginning of our electrical industry and the original exists today through its direct descendant, the General Electric Company. Other men had been experimenting with electricity, among them Charles F. Brush who devised the arc lamp which was widely used for street illumination.

Edison to an amazing degree had detailed plans of what should be devised before starting. His first step was to develop a better lamp, manufacture it in quantity at a reduced cost, distribution of the current, meters to measure it, and large generating plants with reserve capacity for producing the electricity.[15] On October 21, 1879, Edison produced the first successful incandescent lamp at his Menlo Park laboratory.[16] Had his invention been merely a betterment of existant light and power sources existing devices could have been used for its utilization. Edison, however, had to invent every component of an electric generating and distribution system, create a manufacturing system to make them,

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[14]Sidney Alexander Mitchell, S. Z. Mitchell and the Electrical Industry (New York, 1960), p. 31.

[15]Ibid.

[16]"Electricity Supply," Encyclopedia Brittanica, 1962, VIII, 253.

train engineers to install them, and develop a central station industry to buy them. He did it all and for all practical purposes he did it alone.[17]

On September 4, 1882, at 3:00 p.m., the first Edison electric lamp station in the United States began operations in New York City. This first plant served 59 customers and the 1,284 lamps connected on opening day represented a load of approximately 30 watts. The New York Herald reported on the event as a vindication of Edison and the triumph of his light:

> "the dim flicker (of gas) was supplanted by a steady glare, bright and mellow, which illuminated interiors and shone through windows fixed and unwavering."[18]

The same year saw the completion of the first hydroelectric plant and in 1885 electric power was first applied to street railways.

In January, 1881, a personal secretary for Thomas Edison was brought to America from London.[19] This move was, in time, to have a profound effect upon the politics and economics of the Twenties, Franklin D. Roosevelt's regulation policies of the New Deal, the development of power and coal for Chicago and Illinois, and many of the accounting, ratemaking, and

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[17]Forrest McDonald, Insull (Chicago, 1962), p. 26.

[18]Mitchell, p. 36.

[19]McDonald, p. 18.

financing innovations peculiar to the electric industry. The new secretary's name was Sam Insull. Almost immediately after his arrival in New York in late February, 1881, he took over many of the administrative and personal duties of Edison which the inventor tended to neglect. In a short time Insull was to become an expert in the turbulent finance of Edison's early activities in the development of the electrical industry.

The same year that a 5,000 horse power alternating current generator was installed at Niagara Falls[20] another young man was to become associated with Edison who would figure just as surely in the later events of the Twenties and Thirties but in a much less spectacular fashion than the collapse of Insull's Midwest Utilities. His name was S. Z. Mitchell. In 1885, S. Z. Mitchell came to New York after leaving the service of the United States Navy because of a lack of opportunity in the then existing naval service. As a young naval cadet, just graduated from Annapolis, Mitchell had installed the first incandescent lighting system used on a vessel of the United States Navy. This was the U. S. S. Trenton in 1883. This experience led Mitchell to visit Edison in New York after resigning his naval commission. In line with his need to develop electrical engineers for the industry, Edison had inaugurated a system whereby bright

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[20]Williams and others, p. 260.

young men worked with the existing plants and equipment during the day and at night held discussion sessions in Edison's laboratory learning the details of the phenomenon, electricity.[21] Mitchell's contribution to history was to come in his founding of the Electric Bond And Share Company, its development and successful application as a holding company for electric utilities.

Sam Insull and S. Z. Mitchell will be studied later in the paper in describing some of the practices of the utility companies which eventually led to public censure and government--state, local, and federal regulation. The purpose of introducing them here was to impress upon the reader their involvment in the electrical industry almost from conception and their working relationship with Thomas Edison and consequently with the General Electric Company. In both cases the young men and the young industry were to grow up together.

The growth of the electric industry was spectacular and, as mentioned earlier, as each new phase developed it presented new problems to be solved. Many of them necessitated a new invention. Besides the installations and applications of electricity already mentioned, in just six years, from 1880 to 1886, the following items were reported:

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[21]Mitchell, p. 41.

Street lighting by the Brush Electric Light Company (arc lighting) in Cleveland (1870), and a section of Broadway in New York in 1880.

A hand dynamo for a Chinese importer who explained man power was cheaper than steam in China.

Installation of an Edison dynamo in Santiago, Chile.

Operation of an Edison plant at an exhibition in Rio de Janeiro, Brazil.

Payment of capital for Edison European Companies into a Paris bank (3,000,000 francs).

Successful operation of an Edison plant at a textile mill in Lowell, Massachusetts; a locomotive works in Philadelphia; and an electric railway for Menlo Park.

The lighting of a printing plant in New York City; a flour mill in Minnesota; a piano factory; and a railway in New York; the Government Printing Office in Washington; and the Marshall Field Store in Chicago.

Edison lighting of the LaScala Opera House in Milan, Italy.

The first Edison lighting in Russia at Saint Petersburg.

Lighting of a railway station in Rio de Janeiro.

Incorporation of the Edison Electric Light Company of Canada.

Operation of Edison plants at Frankfort and Hamburg, Germany.

A plant installed in a bank at Albany, New York.

Formation of the Edison Electric Light Company, Limited in London with 1,000,000 pounds.

Orders for lighting a McCormick Harvester Plant at Chicago.

Operation of Edison plants in Manchester, London, Paris, Bordeaux, Amsterdam, Munich, Berlin, Brunn (Austria), Bologna, Rome, Santiago (Chile), and Cape Town (South Africa).[22]

These were all comparatively small individual plants. The first electrical equipment was all on a direct current basis and loss of power through transmission and poor insulating techniques made transmission over anything but short distances impractical.

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[22]Ibid. pp. 39-41.

The two principal means of power production are falling water and steam. All fuels produce power of like quality thus price was the only consideration for choosing a fuel. At first generating distribution of any one plant seldom exceeded a square mile.[23] Because of this limitation on transmission, even central stations were of a local nature and any given large city may have had several different central stations serving its areas.

The development of a practical electric streetcar system in 1885 by Charles J. VanDepoele brought about electric power demands that quickly dwarfed that of electric lighting. This development was followed in 1886 by a device, the transformer, perfected by George Westinghouse and William Stanley which made it possible to transmit electricity for scores, even hundreds of miles.[24]

Direct current is transmitted at low voltage. This low voltage resulted in power loss if transmitted over anything except short distances. Alternating current being of a higher voltage could be transmitted over any reasonable distance without a corresponding power loss. But this higher voltage was impractical for consumer use because the machinery, factories, and homes were wired to use the lower voltage. This is why direct current was the more popular means of transmission until approximately 1900. The transformer solved

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[23]Julia E. Johnsen, Government Ownership of Electric Utilities, The Reference Shelf Series, X(New York, 1937), p. 102.

[24]McDonald, pp. 36-37.

this problem uniquely and simply. Current was generated in alternating form to the consumer. It passed through a transformer at the factory site, or near the point of consumption and was changed to a lower voltage suitable for use. This made possible large scale consolidation with resulting savings and economies through larger plants serving more customers and eliminating duplication of investment in plant facilities over a relatively small area. As an example a town of five square miles may have had three central stations, each costing $30,000 and serving 5,000 people. Now one plant costing $50,000 could serve all 15,000 people with fixed plant costs in the first case of $6.00 per customer and in the second of only $3.33 per customer. The example is only a simple illustration not taking into account savings in interest on funded debt, savings in power lines, labor, management, fuel, or load factor. Nor are the given dollar amounts to be considered typical but the principle holds true through all phases of production and maintenance.

The development of the means for transmission led the electrical industry upon a spectacular growth. Before the turn of the century 2,774 power stations were in operation and 2,000,000 electric lights were in use;[25] this from just one station and 1,284 lamps in 1882. Of all industrial motive power in the United States electricity furnished 5% in 1899,

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[25]Williams and others, p. 37.

55% in 1919, and 73% in 1925.[26] In 1923 residential users averaged 368 kilowatt hours per year at an average cost of 7.2¢ per kilowatt hour, or an average annual bill of $26.50. In 1955 the average residential user averaged 2,755 kilowatt hours per year, at an average cost of 2.65¢ per kilowatt hour, or an average annual bill of $72.73. This is less than three times the price for more than seven times the energy. In those thirty-two years the average price per kilowatt hour was reduced by more than 270%.[27] The needs of war increased the demand for electricity to such an extent that the years 1939 through 1945 saw a 50% increase in total electrical output over that of 1937.[28]

In 1929 only one family in five had electricity[29] and before 1936 only 10.9% of farms in the United States were connected with electric power stations.[30] The government was responsible in a large part for the impetuous to electrify rural areas and thus expand the electric industry. The utility companies and rural cooperatives by 1952 had brought central-station service to most farm homes, rural churches, and schools.[31] By 1955 more than 97% of all rural and urban

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[26]Ibid, p. 260.

[27]"Electricity Supply," p. 237.

[28]Williams and others, p. 559.

[29]Ibid, p. 464.

[30]"Electricity Supply," p. 237.

[31]Ibid.

homes were being served. It was estimated that in 1952 the United States generated 42.5% of the world's total electrical output.[32]

By 1955 the electric production industry was the largest business in the United States in terms of plant investment. The public power supply investment was $39 billion with $3 billion owned municipally, $6 billion owned by the government, and the remaining $33 billion in the hands of private, investor-owned companies. The total power was generated by two main sources. Hydro-electric generation accounted for 21.9% of the total output and thermal generation 78.1%. Of this 78%, coal accounted for 53.4%, oil 6.4%, and gas 18.1%.[33]

The reader need only look around to realize the impact on America and her businessmen by the successful application of electricity to light and power. There was no intent to provide a complete history of the growth of electric utilities here but to provide a sketch of the beginnings, and inventions of the industry. The preceding statistics show the scope and rapidity of this growth. It should be kept in mind that this growth needed a tremendous amount of capital to build and maintain the new plants, turbines, and labor used in keeping the supply of available electricity somewhere near the demand.

Many varied items led to the regulation of electric utilities but most authors seem to agree that the collapse of one man's work, Sam Insull's, spurred the government into

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[32]Ibid, p. 236.

[33]Ibid.

definite action. This action was most often directed against the holding companies in the industry. Because of this, the next section will deal more specifically with the growth of the Insull Utilities centered in Illinois and the work of S. Z. Mitchell one of the leaders in the Electric Utility holding movement. Looking at the work of these two men will show how certain practices evolved which the government later stopped or regulated, and a better idea of the formation of a utility in the electrical field.

Formation of some electric utilities

There were three large companies manufacturing electrical equipment Edison General Electric, Westinghouse Electric Company, and the Thomson-houston Electric Company. Westinghouse was in the business with alternating current equipment, Edison with largely direct current equipment and Thomson-Houston one that exploited the improvements and research of the other two. Through a series of financial maneuvers and patent cases in favor of Edison Electric, the Thomson-Houston Company merged with Edison. In April, 1892, these companies became simply the General Electric Company.[34]

Because of the great amount of capital needed in electric businesses and more than that the control of the banking at the time by the great Morgan Banking interests, these companies

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[34]McDonald, p. 51.

were tied to the orders, and whims of J. P. Morgan and his bankers. Sam Insull had been successful in enlarging and managing Edison Electric but for personal reasons and a belief in central power stations, he left General Electric soon after its founding. In July of 1892 he moved to Chicago, Illinois and became president of the Chicago Edison Company. The young man from England who had been Edison's secretary and business manager had left to follow his own theories on the sale and production of electricity.

Insull knew little about managing a central station company but he did feel that electricity was sold best without competition. He did not want monopoly in order to make more money, but felt that if one company could serve all the people the current could be sold more cheaply thus making electricity not a luxury item, but one which could be afforded by everyone. Electricity should be sold at the lowest price possible.[35] His first step was to build a plant with a tremendous expansion capacity and ordering generators of three and four times the capacity of any others in existence. By January of 1893, Insull had succeeded in buying or gaining control of his two largest competitors and their subsidiaries. In doing this, and because of a later purchase, he was able to hold an exclusive franchise on the purchase of electrical equipment of all American manufacturing companies and even the principal foreign companies. Thus Insull and Chicago

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[35]Ibid, p. 57.

Edison could threaten one company with purchase of equipment from their competitor.[36]

Insull was not winning business, but merely the right to do business. In 1892, Chicago had 1,000,000 inhabitants but less than 5,000 of these used electric lights. Because of the high plant investment in the central station, costs remained pretty much the same regardless of the amount of electricity produced. Demands were irregular and because electricity cannot be stored a plant had to be capable of producing enough at any given time to satisfy its largest demand. The cost of connecting lines to consumers, adding to the high investment cost prompted the industry to keep the number of consumers small and the costs up.[37] This fostered the belief that use of electricity in the home would remain a luxury item.

Insull had a conviction, influencing all his strategy, that if he could sell enough power to enough people he could sell it cheaply and profitably. Thus he instructed his salesmen to sell at whatever price it took to induce new business. He followed this policy with long-term contracts to attract the large customers and, at every opportunity the larger volume provided him, reduce the rates to procure new smaller consumers. It should be pointed out here that he knew through total kilowatt sales and plant fixed costs and

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[36]Ibid, p. 62.

[37]Ibid, pp. 63-65.

operating costs whether his total revenues were producing a profit. But he did not know if each particular customer was paying his fair or equitable share of the cost for power consumed and the investment needed to supply him. It was this aspect of pricing electricity that eluded the electrical industry of the time.

Nevertheless, during Insull's first three and a half years in Chicago his companies connected load quadrupled and sales increased from 2.8 to 13.7 million kilowatt hours.[38] A vacation in Brighton, England in late 1894 provided him with the knowledge of how to charge each customer for service.

Arthur Wright managed the municipal power plant in Brighton and had devised a system of pricing. The costs of electric production were fixed and operating. If one customer uses his lights only periodically and another with the same number of lights uses them regularly, you can sell the second power more cheaply because of the better utilization of your equipment. For the first customer you must maintain expensive equipment year round for the few times he may choose to use his lights. Thus, Wright charged for each of the two parts of cost; one part of the charge for the amount of equipment the customer necessitated and another part for how much he used the equipment. Insull carried Wright's thinking one step further perceiving a load factor. That is profits would depend upon varying demand of the customers over the day so that equipment would be constantly at a

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[38]Ibid, p. 66.

level below maximum demand rather than for a time at peak and then set idle. Because of the peculiar relation of fixed costs in the electric central station industry (of $5 to $8 in plant investment for each $1 of revenue[39]) this produced a lower per unit cost of electric power.[40]

Insull's salesmen could now go after new business armed with the methods to calculate the exact cost of this new business and thus underbid other power suppliers. Wright's insight also confirmed Insull's belief that two, even three plants could not serve as economically as one because of the load factor, specifically the percentage of time one plant investment was in active use. These developments and the general information needs of Insull's companies and his own convictions led to his development "of modern business's first statistical departments and pioneered modern cost accounting."[41]

Here expansion brought a new set of problems. Companies supplied by Edison (General Electric) had a large permanent investment in direct current equipment. As Westinghouse Electric proved the successful application of alternating current equipment it became increasingly apparent that direct current generating equipment was at a disadvantage. While Insull-managed companies were unique in their

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[39]Clemens, p. 572.

[40]McDonald, pp. 67-68.

[41]Ibid, p. 58.

rapid rate of expansion, other General Electric supplied operators were hampered by the same problem. They were limited in growth because of direct current transmission problems mentioned earlier. To install alternating current equipment would be too expensive considering the loss in scrapping the direct current generating facilities. Insull's chief engineer, Louis Ferguson, solved this problem quite simply. He took two rotary converters, which are in effect motors for direct current, wound one converter backwards thus from direct current generating equipment he could send out alternating current by passing it through the converter. By using the second converter at existing substations the alternating current was reconverted back to direct current for localized consumption.[42] Now Chicago Edison could serve all of Chicago with a single generating plant using direct current generation and alternating current transmission. Other central station operators used the same technique. One, W. S. Barstow of Brooklyn Edison apparently developed the same idea as Ferguson independently and at the same time.

Now expansion was possible. With the transmission difficulties solved and a sales force capable of selling the power Chicago Edison was hampered only by the huge capital needed for expansion. As early as 1898 Sam Insull foresaw a need of at least $100,000,000 in bonds to finance his immediate plants. In 1896 the bond investment market had disappeared with the nomination of William Jennings Bryan

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[42]Ibid, pp. 69-70.

and Insull was forced to sell $2,000,000 in bonds in London. Here the writer found an interesting discrepancy in two of the sources. S. A. Mitchell on page 114 of his book attributes the first open-end mortgage in the utility field to S. Z. Mitchell in 1919 and says that it was then rapidly adopted by the rest of the industry.[43] Forrest McDonald, however, makes reference to Insull's innovation of an open-end mortgage in collaboration with William G. Beale, a Chicago attorney, in 1898.[44] So along with many other major innovations used widely by modern business, we will attribute the open-end mortgage to Sam Insull. It was this innovation that allowed him to sell his bonds and continue his expansion of Chicago Edison.

This whole period of growth was marked nationwide by financial monopolies controlling stock sales and bond issues on their own terms and at their named interest rates; political payoffs for the issuance or renewal of franchises; and dealings between related companies for the purpose of showing a book profit or realizing an interest expense. Without attempting to explain the reasons for these payoffs, padded expenses, and stock watering it is sufficient for the reader to realize that they were in existence and a part of the problems which all utilities had to face during their development. In the reforms of the LaFollettes, the New Deal and the literature of the times these abuses were

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[43]Mitchell, p. 114.

[44]McDonald, pp. 91-92.

attributed to the electric industry executives. But if one will only read a bit of history he soon realizes that these abuses were a product of the times and the policy of laissez-faire rather than of the electric industry itself.

One development worth noting in the growth of Chicago Edison was an agreement between Insull and Francis S. Peabody. Peabody wanted to become a large-scale miner in the coal industry. He was until 1903 only a coal distributor and a Chicago politician. Peabody needed capital. Insull had capital but needed coal. The two men negotiated a long-term contract whereby Peabody furnished coal to Chicago Edison for "generations" at cost plus a reasonable profit. On the basis of this contract Peabody could raise the money to purchase mines.[45] Thus the Peabody Coal Company was founded which even today furnishes a large part of the coal used in Kentucky, Indiana, Missouri, and Illinois. This contract had one other major result to many of the people of Illinois. In return for a union contract favorable to Peabody an agreement was reached with John L. Lewis whereby Peabody would lend his political support to pass legislation in Illinois for standards of mine safety and strive for recognition of Lewis' Illinois Mine Workers Union. The apparent legislation resulting from this agreement was the creation of the Illinois Mining Investigating Commission. Lewis' rise as a

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[45]Ibid, p. 108.

labor leader is well known; his only concession to Peabody was that all contracts expire on April 30--a slow time in the coal industry--when negotiations, or a strike, would not seriously cripple the company earnings.[46]

In 1907 Insull received approval of the stockholders to merge his Chicago Edison and Commonwealth Electric companies into the Commonwealth Edison Company. In 1911 he formed five smaller companies into the Public Service Company of Northern Illinois. As the number of companies under Sam Insull's direction increased and their needs for expansion grew, he found his main problem was how to finance them. He had purchased some utility properties around New Albany, Indiana, and turned over their management to a younger brother, Martin.

Martin Insull was highly competent and the New Albany properties were experiencing rapid expansion. Because of Sam Insull's personal involvement in Public Service Companies of Northern Illinois his personal credit was strained. In May, 1912, it was decided to form a holding company. By turning over the New Albany properties to the new company they could then sell the stock of the holding company thus raising capital. It was felt that because of Sam Insull's reputation as a successful manager no difficulty in selling the new stock would be encountered. If the companies held by the parent company were successful then those who participated would gain by the appreciation of the holding

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[46]Ibid, pp. 109-110.

company's assets. Thus was born the Middle West Utilities Company. Interestingly enough, one of the first companies purchased by Middle West after its founding was Central Illinois. In 1912 Central Illinois operated a streetcar line in Mattoon, a twelve mile line from Mattoon to Charleston, and small central stations in these towns and Kansas, Illinois. From this beginning Central Illinois Public Service Company was formed extending service to 150,000 customers in Central and Southern Illinois by 1930.[47] In time Middle West would experience a spectacular growth, controlling a spectacular amount of utility enterprises, and just as spectacularly crash in the panic of 1929 and the 1930's. One author writing at the height of the backlash of public opinion and government investigation of the electric industry points out that the "Insull Interests" controlling Middle West through two investment companies had effective control over 248 companies. This group served 4,741 communities in 30 states. He also states that, "the capital investment . . .grew from $12,000,000 in 1912 to $275,222,378 in 1930."[48]

The first holding company in the United States was the American Sugar Refining Company founded in 1891.[49] A holding company can make money in three ways: charging exorbitant

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[47]Ibid, pp. 150, 153.

[48]Carl D. Thompson, Confessions of The Power Trust (New York, 1932), p. 232.

[49]Williams and others, p. 35.

fees for the construction of plant facilities, charging excessive financing charges to the captive operating companies, and to build the operating companies into valuable, moneymaking concerns, thus adding to the value of your holdings.[50]

Carl D. Thompson lists the advantages of a holding company in the utility field as follows.

1. "Financing on better terms than the local operating companies could command.
2. Rendering expert engineering and construction services at minimum cost.
3. Massing purchasing requirements of many subsidiaries, thus saving money for all of them and tending to reduce cost.
4. Giving small local companies the managerial ability and experience available to the largest companies.
5. Helping to make weak companies self-supporting by assisting them financially and making improvements and extensions necessary to make them self-supporting.
6. Improving the quality and reliability of service in small communities.
7. Displacing small inefficient plants by large generating systems.
8. Giving service from high tension interconnections to farms and small communities who could not themselves support individual plants."[51]

For a more detailed study of a holding company we leave Insull and Chicago for New York and the Electric Bond And Share Company under the direction of S. Z. Mitchell who was mentioned earlier in this paper. The reasons for studying Bond And Share instead of Middle West Utilities are several.

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[50]McDonald, p. 152.

[51]Thompson, pp. 85-86.

A very important reason is that Bond And Share was not at first conceived as being a holding company but evolved into one. This evolution more clearly shows why there was the growth experienced in the number of electric holding companies during this period. Bond And Share was a product of a large manufacturing company's financing difficulties rather than of one man as in the case of Sam Insull and Middle West. It survived the crash of 1929 and thus avoided the storm of adverse public opinion generated after this business crisis. For the most part Bond And Share started out with the securities of small, little known companies that General Electric could not dispose of elsewhere. It was the largest holding company in terms of generating capacity; Mr. Insull's group being the second largest. It provides us with a clearer picture of the services and advantages to be gained in large-sclae financing.

S. Z. Mitchell left New York in 1885 to become exclusive agent for Edison Electric Light Company in the northwestern states. He and his partners by 1888 had sold, found the necessary financing, constructed, and developed lighting companies in Portland, Oregon; Spokane, Washington; Boise, Idaho; Victoria and Vancouver, British Columbia; Port Townsend, Washington and other towns. When Edison Electric merged with Thomas-Houston Mitchell remained as the agent for the new company. General Electric had acquired securities of

various companies in return for equipment sold to them. The panic of 1893 forced General Electric to dispose of most of these securities but for some there was no market and others they were not willing to sell. They had two wholly owned investment companies to whom they sold their better securities. C. A. Coffin, president of General Electric conceived of a company to deal in these "cats and dogs." Mitchell had been dealing with companies largely of this nature in the West, reorganizing them and placing them on a sounder financial footing with such success that Coffin called him to New York where they worked out the plans for Electric Bond And Share.[52]

In March, 1905, General Electric transferred to Bond And Share $1,300,000 of cash and securities in return for 19,995 shares of common stock and 20,000 shares of preferred stock. The securities were of 31 different companies having a par value of $4,258,150 and a book value of only $3,139,522.[53] Of these companies only four had a book value exceeding par. (One of the four was Chicago Edison Company, managed by Sam Insull, with a par value on the securities held of $124,900. and a book value of $199,840.) Most of the securities represented a minority interest. The conception of Bond And Share was that it be an expert engineering and service organization and investment banker.

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[52]Mitchell, pp. 60-61.

[53]Ibid, pp. 62-64.

It must be remembered (as stated earlier) that on an average it took $5 of invested capital to produce $1 of revenue. The early electric stations were financially shaky at best and as the demand for electricity grew it became increasingly difficult for the small companies to raise the finances needed. Here the holding company entered the picture. By selling its own securities (when first formed at highly discounted values) it raised capital to invest in these small companies. The holding company then provided managerial skill, reorganization, engineering aid, and construction to make the small company a profitable growing enterprise. If the holding company was successful the securities it held (its assets) became more valuable, the public had more confidence in it, and the holding company's stock could be sold at higher prices to raise more capital for greater expansion. These services were provided to the smaller companies for a fee thus adding to the holding company's profit. Consolidation was often used for greater efficiency and from this developed situations where Bond And Share actually organized other holding companies under it.[54]

Electric Bond And Share was successful as witnessed by its growth to the number one position. In each endeavor undertaken by Mitchell and his company the principles were the same:

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[54]Ibid, pp. 70-71; 102.

> "Get rid of the traction companies; retire all debt and preferred stock of the constituent companies; merge all these small companies into one big one that can be financed; sell new bonds under a new open-end first mortgage to the public and sell preferred stock locally to retire the underlying securities; to build new modern generating plants and transmission lines to interconnect the plants; and, above all, reduce rates and give dependable service."[55]

The success of Mitchell's efforts, and in an indirect fashion, the need of companies for sound financing outlets can best be shown by some pertinent figures in relation to their total. In 1930 of all gross electric revenues in the United States, Electric Bond And Share accounted for 12.3% through their holdings. In 1937 Bond And Share showed consolidated assets of $2,626,284,057. This from total assets of all registered Public Utility holding companies of $13,869,830,680.[56]

Practices leading to regulation

The size and power exhibited by the public utilities was noted by many reformers. There had always been an attempt at regulation through the common law. This regulation was mainly carried through the use of franchises granted locally and most generally controlled by politics. The utilities thus had long had an interest in the public officials to be elected. This manipulation, and contribution to many campaigns was often made an issue for election by reform elements. In Illinois the University of Chicago had

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[55]Ibid, pp. 102-103.

[56]Clemens, pp. 498-499.

a group of professors who were for a limitation on the power of the Utilities. In this group was Paul Douglas (now Senator). Senator James Reid of Missouri raised the issue of utilities manipulating elections. Governor Gifford Pinchot of Pennsylvania and Robert M. LaFollette of Wisconsin were other well-known reformers of the period.

As the success of these men encouraged more to take up the issue the American public became more aware of the issue and just how deeply the large electric companies were engaged in rate fixing, stock manipulation, and political activity. The market crash of 1929 brought on a resentment of big business by the many small investors and directly led to many phases of regulation. There was a definite concentration of control exercised by a relative few in the Power Industry. By 1900 the supply of electrical equipment was dominated by two companies, General Electric and Westinghouse Electric.[57] By 1928 the holding company movement had been such that 5,000 various individual utilities were brought under one system or another.[58] In the 1930's thirteen companies controlled 75% of the nation's electric power.[59]

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[57]Williams and others, p. 37.

[58]Ibid, p. 441.

[59]Ibid, pp. 507-508.

The general public concern seemed to be in two main areas. That the utilities, being in a monopoly situation, were not passing on savings to the consumers by lowering rates and that there was manipulation of stock and bond transactions to enrich those few in control. The Federal Trade Commission classified the abuses as follows:

1. Excessive pyramiding of companies with a minimum of investment to secure control.
2. Excessive valuation of capital accounts to increase the rate base.
3. Writing up of fixed assets and creating fictitious surplus.
4. Creating arbitrary profits through inter-company transactions.
5. Excessive charges for services to captive subsidiaries.
6. Control of financing leading to excessive interest costs.
7. Manipulating the security markets.
8. Evasion of state laws in effecting sales of security issues.[60]

This is a partial list of the abuses found listed in the "Public Utility Holding Company Act of 1935."

As public opinion mounted against the Electrical Industry the first tentative step was taken towards federal regulation of power. This was the passage of the Water Power Act of 1920.[61]

Federal regulation

The Federal Power Commission was created by Congress to implement the new Act. The Commission sets regulatory standards for the gas and electricity interests on a national scale and provides guidance to the various state

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[60]Emanuel Stein, Government and the Investor (New York, 1941), pp. 161-162.

[61]Williams and others, p. 412.

commissions. It is its job to maintain a watchdog attitude over electric rates and to correct the abuses mentioned previously that led to creation of the commission.

When created, the Commission was composed of the Secretaries of War, Interior, and Agriculture and was concerned only with the licensing of non-federal hydroelectric projects. In 1930 the Commission was made an independent agency with five full time commissioners. The Federal Power Act of 1935 and the National Gas Act of 1938 enlarged its powers to substantionally what they are today. Besides its licensing of hydroelectric projects the Commission now has the responsibility of assuring an abundant supply of electric power at a minimum cost, the proper utilization and conservation of natural resources, and a voluntary interconnection of various private generating facilities. It also regulates interstate rates of electric utilities, and their securities, mergers, consolidations, acquisitions, and books of accounts.[62]

There is an Executive Director to aid the five commissioners. He coordinates eleven separate bureaus that carry out the duties assigned to the Federal Power Commission. These bureaus include Bureau of Power, Bureau of Natural Gas, Office of the General Counsel, Office of Accounting and Finance, Office of the Secretary, Office of Hearing Examiners, Office of Economics, Office of Special Assistants, Office of Public Information, Office of Administration, and the Office of Personnel. For the fiscal year 1964, Congress

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[62]Forty-third Annual Report, Federal Power Commission, (Washington, D. C., 1964), pp. 6-8.

appropriated $11,850,000 for the Federal Power Commission's operations. The Commission employed approximately 1,100 people in 1963-1964.

Commission members serve a term of 5 years. Those currently on the Commission are: Chairman Joseph C. Swidler, and commissioners H. C. Woodwards, L. J. O'Connor, Jr., C. R. Ross, and D. S. Black.

During the fiscal year 1963 the Commission ordered natural gas refunds of nearly one-half billion dollars, issued guidelines for determining natural gas prices at wholesale, established new hearings procedure, disallowed price increases on natural gas in Louisiana and Mississippi, ruled on accounting treatment of deferred taxes, refused renewal of hydroelectric project licenses until they expire, and instituted plans for providing development of public recreation facilities at hydroelectric sites.[63] The preceding were those actions considered by the Federal Power Commission to be the most important and far reaching of their decisions. The Commission received thirteen court opinions during the year. In one of the cases involving Southern California Edison Company the circuit court held against the Commission's right to regulate rates in this instance. The decision has been appealed to the Supreme Court.[64]

A major project undertaken during the year was an Interdepartmental Energy Study. It is a joint project of ten Federal agencies including the Federal Power Commission.

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[63]Ibid, pp. 11-16.

[64]Ibid, pp. 22-24.

"The purpose of this study is to investigate thoroughly the nation's energy resources and their use, with particular emphasis on the amount of research being carried on at the present time in the various energy segments." The group will then recommend areas where further research would be fruitful, a future form for coordination of Federal research projects in the energy field, and allocation of Federal funds for the projects.[65] The Commission also compiles numerous reports, statistical studies, growth rates, and general information on all activities of the electric and gas industries of the nation.

State regulation

To operate a public utility permission must be granted by a public authority. This authority may be conveyed by corporate charter, a franchise, certificates--a permit or license, and a certificate of convenience and necessity. Experience has shown that without this control over entry into business, price and service regulation breaks down.[66] The corporate charter was used to place restrictions on utilities when a special act of the state legislature was needed to grant one. The franchise was usually granted by a municipality. The franchise may have been short-term, long-term, or perpetual in length. Many abuses centered around the granting of franchises. The licenses are for businesses usually not regulated and carry no monopoly rights

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[65]Ibid, p. 27.

[66]Clemens, p. 72.

as franchises often do. The certificate of convenience and necessity is for a specific purpose such as to construct facilities, but conveys no property rights.

For electricity the franchise was most often used on a city, or municipal basis. There were abuses on both sides. The city council may issue a franchise to a third party strictly with the intent of selling it to the existing company and dividing the profit. If the franchise was up for renewal the company may have had to bribe council members. The move away from municipal regulation to regulation at the state level was necessary generally because the small city councils had neither the finances or quality of executives to successfully thwart the electrical producers.

Today commissions are the means used to regulate public utilities at the state level. Temporary railroad commissions in New England existed as early as 1830. Permanent railroad commissions for Rhode Island and New Hampshire were established in 1844.[67] In 1907 New York, Wisconsin, and Georgia established strong mandatory commissions to regulate local utilities. This was the start of the movement for state commissions and by 1913 there were 28 established state commissions.[68]

State commission jurisdiction does vary but in general covers electric, gas, city transportation, telephone, and water companies. In 1948, of the 48 state commissions,

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[67] Ibid, p. 40.

[68] Ibid, p. 41.

42 had jurisdiction over Electric Light and Power. The state commissions vary in size from one to seven commissioners but three seems to be the average. They may be appointed or elected but appointment coupled with a reasonable tenure gives the commissioner time to learn his job and unhampered by elections he can make decisions unswayed by public opinion. The commissioners may have little or no staff under them but a median of 12 was found on 40 commissions studied. The New York Commission had 279 employees, Wisconsin 213, Illinois 180, Indiana 57, and Pennsylvania 76.[69] Commissions today generally rely upon assessments for their operating income. These assessments are applied to the companies they regulate, general assessments being levied against all companies under the commission and special assessments against a company where an expense could be attributed to that company. By using the assessment type of financing the commission is assured the finances needed to successfully challenge the utilities in prolonged court cases which legislatures may not see fit to provide.[70]

If a commission is to do a sound job in exercising its powers it must have "(1) adequate financial resources, (2) good administration as reflected by the character, ability, and energy of the commission and its staff, and

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[69]Ibid, p. 410.

[70]Ibid, p. 414.

(3) the proper political climate in which to work."[71] With the growing use of government regulation over business our state commissions represent the people at the local level. Where the Federal Power Commission is concerned with the use of the nation's resources as a whole the state commissions rule on property valuation, depreciation policies, rate of return, rate schedules, accounting, financing, competition, and legislative needs at the state and local level.

Pertinent statistics of the electric utility industry

Americans are accustomed to leading in almost all matters but particularly in industry and industrial production. The United States is the number one country in the world in terms of total installed capacity and kilowatt hours of electric power produced. In 1962, the United States produced just under 947 billion kilowatt hours while the Union of Soviet Socialist Republics, in the number two position, produced 346 billion kilowatt hours or approximately 37% of that produced by the United States. The United Kingdom was third producing 151.8 billion or approximately 16% of that produced by the United States.[72] The increase in total utility power requirements for 1962 over 1961 was 59 billion kilowatt hours or 7.4%. There were only seven countries in the entire world who used as much electric power as this increase alone.[73]

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[71]Ibid.

[72]Federal Power Commission, p. 91.

[73]Ibid, p. 47.

The average home in 1962 consumed over 4,000 kilowatt hours, the 1955 average being 2,755 kilowatt hours. The total per capita consumption was 5,100 kilowatt hours.

The facilities installed in the United States for production of electrical energy totaled 42.4 million kilowatts in 1941; 50.3 million in 1946; 75.7 million in 1951; 120.2 million in 1956; and 177.9 million in 1961. This was an increase in the twenty-year period of more than 400%. The energy produced by these facilities increased from 164.8 billion kilowatt hours in 1941 to 792 billion kilowatt hours in 1961. An increase of 480% and the 80% difference in installed capacity and energy produced shows a corresponding growth in efficiency and improvement of the electric facilities.[74] Summaries of the production of electrical generating plants for 1962 show that steamplants produced 679 billion kilowatt hours, hydroplants 168.1 billion, internal combustion plants 4.8 billion, and nuclear-fueled power plants 2.3 billion. The relative percent of hydro- and steam-power stated earlier in this paper of 21.9% and 78.5% respectively has become in 1962, 19.7% and 79.5%.[75]

The following partial chart taken from page 56 of the "Annual Report to Congress - 1963," of the Federal Power Commission shows clearly the trend in the relative importance

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[74]Ibid, p. 50.

[75]Ibid, p. 53.

of the primary fuels used in electricity production expressed as a percent of the total kilowatt hours produced for each year. Note the general trend of decline in hydroelectric sources and the increase in gas as a utility fuel:

Energy source	1920	1930	1940	1950	1960
Hydro	40.00%	34.23%	33.36%	29.15%	19.32%
Gas	1.55	6.93	7.71	13.54	20.97
Oil	5.36	3.07	4.36	10.25	6.12
Coal*	53.09	55.77	54.57	47.06	53.59

*Including nuclear fuels of less than .02%.

The nation's privately owned electric utilities continue to show growth as experienced by the whole economy. Revenues for electric service rendered in 1962 were $11,392 million, an increase of $726 million over 1961. Plant investment for this same period increased by $2.6 billion. The 1962 increase over 1961 in sales was 7.9%, revenues increased 6.9% and the total number of ultimate consumers increased 1.4%. Net income was $2,052 million up 9.4% from 1961 of which $1,480 million (72%) was distributed as dividends to stockholders. For the ten year period 1952 to 1962 plant investment increased by 225%, income 233%, sales 200%, and income 200% for the privately owned electric utilities.[76]

The total sales in kilowatt hours of electricity by private utilities in the following chart are classified by consumer types. The residential and commercial totals having tripled from 1950 to 1962 while the industrial total increased by approximately 2½ times.

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[76]Ibid, p. 62.

(Millions of kilowatt hours)

Class of Service	1950	1955	1960	1962
Residential	72,200	128,365	200,798	231,998
Commercial	52,091	78,765	132,892	151,896
Industrial	144,479	260,608	321,332	354,949
Other	22,127	29,016	31,472	32,872
Total	290,897	496,754	686,494	771,715[77]

The composite balance sheet for privately owned electric utilities in the United States appears on pages 168 and 169 of the "Annual Report to Congress - 1963," Federal Power Commission and a composite income statement for these same companies appears on pages 170 and 171. No attempt is made to present these statements fully but to condense them into broad figures of interest to the reader that will be useful in our study of the Union Electric Company of Missouri for comparative purposes.

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[77]Ibid, p. 167.

Privately Owned Electric Utilities in the United States
Composite Balance Sheet
December 31, 1962

(thousands of dollars)

Assets & Other Debits			
Total utility plant	$56,158,108		
Accumulated provision for depreciation and amortization	11,671,837		
Net total utility plant		$44,486,271	90.4%
Other property and investments		1,125,356	2.3
Current and accrued assets		3,319,560	6.7
Deferred debits		260,150	.6
Total assets and other debits		$49,191,337	100.0%
Liabilities & Other Credits			
Common stock issued	$ 9,826,810		47.3%
Preferred stock issued	4,497,950		21.6
Premium on capital stock	1,842,584		8.9
Other capital stock items	2,225		.7
Other paid-in capital	229,934		
Capital stock discount and expense	(83,350)		
Earned surplus	4,478,970		21.5
Reacquired capital stock	(897)		
			100.0%
Total proprietary capital		$20,794,226	42.3%
Long-term debt		22,912,188	46.6
Current and accrued liabilities		3,285,141	6.7
Deferred credits		226,370	
Operating reserves		128,062	1.1
Contributions in aid of construction		217,801	
Accumulated deferred income taxes		1,627,549	3.3
Total liabilities and other credits		$49,191,337	100.0%

Privately Owned Electric Utilities in the United States
Composite Income Account
December 31, 1962

		(thousands of dollars)
Operating revenues	$13,468,468	
Operating expenses	10,636,643	
Net operating revenues	$ 2,831,825	
Income from utility plant leased to others	2,153	
Total utility operating income		$ 2,833,978
Other income		72,665
Total income		$ 2,906,643
Miscellaneous income deductions		80,589
Income before interest charges		$ 2,826,054
Interest charges:		
Interest on long-term debt	$ 827,497	
Amortization of debt discount and expense	11,458	
Amortization of premium debt-credit	5,054	
Interest on debt to associated companies	4,509	
Other interest expense	24,629	
Interest charged to construction-credit	88,929	
Total interest charges		774,110
Net Income		$ 2,051,944
Dividends declared - preferred stock		$ 205,117
Dividends declared - common stock		$ 1,274,811

From this rather broad study of the development and current status of the electrical industry in the United States attention is now focused upon one specific company, the Union Electric Company of Missouri.

Brief history and background of Union Electric Company

The Union Electric Company was incorporated in Missouri in 1922. Its principal offices are in St. Louis, Missouri. It is successor to a number of companies the first of which was organized in 1881. Union Electric owns all of the common stock of Missouri Power and Light Company and over 99% of

the common stock of Missouri Edison Company. As of June 30, 1963, these subsidiaries accounted for only 8% of the consolidated total plant and 13% of the consolidated total entity. Thus a very substantial portion of the company's business is conducted under the Union Electric title.

Total operating revenues for the Company and its subsidiaries have been averaging 95% from the sale of electrical energy for the period beginning April 1, 1960 and ending June 30, 1963. Approximately 3% to 3½% of consolidated earnings for the same period was derived from the sale of natural gas. Union Electric supplies principally electric service to an estimated population of 2,265,000 people living in an area of approximately 19,200 square miles in Missouri, Illinois, and Iowa. A list of some of the more important industries served show a wide diversity including lead mining, petroleum refining, iron and steel foundries, manufacture of glass products, drugs, chemicals, stone, cement, food products, automobiles, paper, rubber, aircraft, shoes, and components of our space exploration machinery.

Union Electric and its subsidiaries are subject to regulation by the Missouri Public Service Commission as to rates, service, accounts, and issuance of securities. It is subject to the Illinois Commerce Commission, the Iowa State Commerce Commission, and the Federal Power Commission in such matters as pertain to interstate commerce.

As of June 30, 1963 the Company and its subsidiaries had 6,399 employees, 30% of which have been associated with Union Electric twenty years or more. Consistent with these long-term employees is the Company policy of paying fair wages and job satisfaction with the inclusion of several generally recognized insurance, retirement, and facility programs provided by business today for its employees.

Union Electric owns six steam electric generative plants, the largest with a capacity of 917,000 kilowatts is known as the Meramec plant located near St. Louis. It has two hydroelectric plants at Osage and Keokuk and one pumped-storage hydro plant in the Taum Sauk area dedicated in the fall of 1963. These plants have an estimated capacity of over 2½ million kilowatts with just under 2 million being steam-generating equipment. Missouri Power owns eight electric generating plants with a capacity of 57,000 kilowatts.[78]

Recent development, plans, acquisitions

During 1963, the Company spent over $50 million in new plant investment. For the years 1959 to 1963 the total investment in new plant was over $290 million and the forecasted new plant investment for the next five years (1964 through 1968) is $346 million. Union Electric considers this expansion necessary to meet future needs. It is anticipated that by 1968, annual gross revenues will have

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[78]Background and current facts of the Union Electric Company on pages 41, 42, and 43 taken from Prospectus: Preferred Stock, $4.56 Series, Union Electric Company, (St. Louis, November 20, 1963), pp. 2-7.

increased 40%, total plant investment rising to over $1 billion, and peak load capacity (the amount of energy that can be generated at any one time) increasing by 1/3 to 4 million kilowatts. Union Electric feels this growth will be stimulated by the trend towards "full-electric homes," the rising use of high intensity street lighting by commercial areas, the rising use of electric heating installations for homes, commercial, and industrial establishments, the current industrial expansion especially in the St. Louis area, and the general stimulus of a rising economy.[79] Construction has been started on a new plant near the confluence of the Mississippi and Missouri rivers. The first section will include a 525,000 kilowatt turbo-generator. The Federal Power Commission Report, referred to earlier, lists this particular steam generation technique as extremely efficient and that of Union Electric as one of the five largest in the United States planned in the near future.

Taum Sauk plant

On October 9, 1963, one of the world's largest pumped-storage power plants was dedicated by Union Electric. It is known as the "Taum Sauk Pumped Storage Hydro Plant." The plant is located in the Ozarks near Lesterville, Missouri, approximately ninety miles from St. Louis. The Taum Sauk Plant has generated worldwide interest with numerous technical

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[79] Annual Report - 1963, Union Electric Company, (St. Louis, February, 1964), pp. 5-14.

articles, publicity stories, inspection delegations, and even a working model on display at the New York Stock Exchange to acquaint the public with this unusual innovation.

The basic principle of pumped hydro-storage is not new. It is essentially the use of energy produced during an off-peak period to pump water from a lower level pool (or lake) to a higher pool. Then during a peak period the water in the higher level pool is allowed to flow into the lower level, through hydro-electric equipment, producing electric energy.[80] This amounts to creating energy when needed by forcing water through generating facilities at a lower level and pumping the same water to the higher level with energy produced by other facilities no then in use. There is a loss of about 1/3 in power here but electricity cannot be stored, so the off-peak use makes better overall efficiency. The use of hydro-storage also meant that the company could postpone new plant construction for a later period.

The Taum Sauk Plant is fully automated, needing no operators. It was constructed at a low cost of approximately $50 million. The plant's pump-turbogenerators will move 5 million tons of water in a single night and during the day produce 350,000 kilowatts for the system.

Power grid hook-up

One development of 1963 important to a national system of interconnected electrical supply was the announcement of an

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[80]George P. Gamble, "Union Electric Taum Sauk Pumped-Storage Hydro Plant," reprint from Power Engineering Magazine. (Union Electric Company, St. Louis), p. 1.

association known as Mid-Continent Area Power Planners. The association is composed of Union Electric and twenty-one other midwestern power suppliers. These companies, serving ten midwestern states plan to create a $280 million extra high voltage transmission line over 5,400 miles. This will allow exchange of large blocks of power between the member companies. The association plans by 1980 to create one of the largest associations in the world with a projected cost of $2¼ billion.[81] This project is an enlargement on previous practices of interconnecting adjoining companies to provide a higher reserve capacity and more dependable service.

The large scale hookup and eventually one in which all producers in the nation can interconnect their lines, one with another, is a project encouraged by our government and the purpose of a large survey currently being conducted by the Federal Power Commission and others. This type of national grid is in existence in England.

Electric Energy, Incorporated

The Company owns 40% of the stock of Electric Energy, Incorporated which operates the one-million kilowatt steam generating plant at Joppa, Illinois. This plant was created to supply the needs of the Atomic Energy Commission project at Paducah, Kentucky. Currently 73% of the production goes to Paducah and the excess is shared by the companies owning stock in Electric Energy. Together with this connection for

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[81]Union Electric Company, 1963 Annual Report, p. 8.

the importing of electric energy, Union Electric is interconnected with the Kansas City Power and Light Company and Central Illinois Public Service Company for the exchange of power in time of need or emergency.[82]

Pertinent statistics for Union Electric

During the year 1963, kilowatt hour sales for Union Electric were 10.4 billion, an increase of 9% over 1962. Sales of 1962 showed an increase of 8.5% over 1961, the increase nationwide for that year averaged 7.9%. Operating revenues increased 6.6% and net income 6.5% over 1962. Sales to industry for 1963 increased by 11%, residential sales gained by 7.5%, and commercial sales were up 4.2% over the previous year.[83] The average residential customer had an annual use of 4,201 kilowatt hours which is commensurate with national averages for residential consumption.

The percent of total kilowatt hour sales of Union Electric to the major classifications of consumers for selected years are shown in the following chart. National percentage averages were computed from totals on page 39 of this paper.

Class of Service	1955		1960		1962	
	U.E.	NAT.	U.E.	NAT.	U.E.	NAT.
Residential	20.1%	25.8%	25.3%	29.2%	25.9%	30.1%
Commercial	11.3	15.9	12.9	19.4	12.7	19.7
Industrial	60.8	52.5	51.8	46.8	51.7	46.0
Other	7.8	5.8	10.0	4.6	9.7	4.2

[82]Ibid, pp. 7-8; 10.

[83]Ibid, pp. 5-6.

For the ten year period, December 31, 1953, to December 31, 1963, total kilowatt hour sales increased from 6,746 million to 10,407 million, approximately 65%. Of the total electricity produced in 1963 by the company, steam generation provided 80.5%, hydro-production 7.7%, and 11.8% was purchased. The same percentages respectively for 1962 were 80.5%, 11.8%, 7.7% (see page 37 of this paper for national averages). The company's hydro generation has decreased from 14.2% in 1953, 15.7% in 1958, and a high of 16.7% in 1961; steam generation has fluctuated from 84.6% in 1953, to 74.8% in 1958, and a low of 73.3% in 1961 for the ten year period. The purchased power has shown a steady increase from 1.2% in 1953, 9.5% in 1958, and 10% in 1961 to its present 11.8%.[84]

The average residential customer has used an increasing amount of kilowatt hours each year. While the annual bill has increased because of the increasing consumption, the average price per kilowatt hour for the ten years 1952 to 1962 has been 2.52 cents. In 1962 the average was 3,968 kilowatt hours with an annual bill of $102.12 and an average kilowatt hour price of 2.57 cents.[85]

The following balance sheet and income statement for Union Electric are presented for use in comparing major division percentages with the composite statements for the

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[84] Financial And Operating Statistics, 1963, Union Electric Company, (St. Louis, 1964), p. 6.

[85] Financial And Operating Statistics, 1962, Union Electric Company, (St. Louis, 1963), pp. 4-5.

national industry presented on pages 40 and 41 of this paper. Where applicable, relative percentages from the national statements are provided in parentheses.

Union Electric Company[86]
Consolidated Balance Sheet
December 31, 1962

ASSETS			
Utility properties, at cost	$882,612,965.		
Less reserve for depreciation	203,349,277.		
Net utility properties	$679,263,688.	94.6%	(90.4%)
Investments, at cost	2,972,110.	.4	(2.3)
Current assets	34,834,820.	4.9	(6.7)
Deferred debits	850,379.	.1	(.6)
Total assets and other debits	$717,920,997.	100.0%	(100.0%)
CAPITAL AND LIABILITIES			
Common stock	$114,026,220.	42.0%	(47.3%)
Preferred stock	59,359,500.	21.9	(21.6)
Premium on capital stock	27,473,051.	10.1	(8.9)
Other capital stock items	1,339,302.	.5	(.7)
Earned Surplus	69,021,665.	25.5	(21.5)
		100.0%	(100.0%)
Total proprietary capital	$271,219,738.	37.8%	(42.3%)
Long-term debt	357,603,000.	49.8	(46.6)
Current and accrued liabilities	61,151,741.	8.5	(6.7)
Deferred credits	7,195,518.	1.0	(1.1)
Accumulated deferred income taxes	20,751,000.	2.9	(3.3)
Total liabilities and credits	$717,920,997.	100.0%	(100.0%)

[86] Ibid, p. 8.

Union Electric Company
Consolidated Income Statement[87]
December 31, 1962

(Thousands of dollars)

Operating revenues		$173,922
Operating expenses		132,962
Net operating revenues		$ 40,960
Other income		278
Gross income		$ 41,238
Other expenses and deductions		12,185
Net income		$ 29,053
Preferred dividends		$ 2,164
Balance to common stock		$ 26,889
Total operating revenues	95%	(99.3%)
Other revenues	5	(.7)
Total revenues	100%	(100.0%)

Selected items expressed as a percent of operating revenues: items in parentheses are from the national composite income statement.

Maintenance and depreciation	20.8%	(16.5%)
taxes	18.9%	(20.0%)
gross income	23.7%	(21.6%)
net income	16.7%	(15.3%)
balance to common stock	15.5%	(13.7%)

From these percentages it would seem that Union Electric operated more efficiently than the national average of other utility companies.

The company in 1962 had a ratio of interest charges to earnings of 4.1:1 before taxes and 3:1 after taxes. The ratio of total deductions to earnings was 3.4:1.[88]

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[87] Ibid, p. 2.

[88] Ibid.

The capitalization ratios in 1958 were 55.5% long-term debt, 12.4% preferred stock and premium, and 32.1% common stock and surplus. In 1962 these had become 56.9%, 9.7% and 33.4%. There had been a yearly reduction of the ratio in preferred stock capital, but the sale of $20 million of preferred stock in 1963 raised it to 11.8% of the total capitalization.[89]

The company had in 1962 an investment in tangible electric plant of $5.18 for each $1. of revenue and $696 per kilowatt of the system's peak capacity.[90] This is and has been about the average in the industry. As noted earlier in this paper, the electric utilities have historically had a high ratio of fixed assets to revenues.

What of the future for electric utilities? Will the demand for electricity continue to grow or has it reached its peak. Will nuclear-powered plants replace the conventional plants of today?

The future for electric utilities

The National Power Survey being conducted by the several departments of the United States government show that by 1980 energy requirements of the electric utility industry may be 3½ times what they were in 1960. This increase is 350 million kilowatts. Studies and research are being constantly carried on to insure that the industry can meet these needs as they occur.[91]

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[89] Ibid, p. 11.

[90] Ibid, p. 10.

[91] Federal Power Commission, p. 43.

Extra high voltage lines

One major step in meeting these needs is the use of extra high voltage lines. These extra high voltage lines are currently in use in the 345,000 volt capacity with plans for 500,000 volt and tests are being conducted for extra high voltage lines of 750,000 volts. It is the extra high voltage lines that enable the large exchange of power between operating systems enabling a better use of facilities. This is accomplished by connecting a winter-peak system to a summer-peak system, or a day-peak to a night-peak system, and also by enabling the construction and use of larger capacity plants too big for one system with substantial savings in fixed costs.[92]

Supercritical steam electric generating plants

The supercritical steam electric generating unit is capable of operating at pressures much higher than previous units. This gives the unit a higher kilowatt capacity than could be attained from earlier single units. These units are in operation in the 125,000 to 450,000 kilowatt range. A 900,000 kilowatt unit is planned for near-future operation. (Union Electric in its new Sioux plant will have two of these generators in the 500,000 kilowatt range.) These are the units which will enable the utilities to build the huge plants made economically practical by interconnection with the extra high voltage lines.[93]

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[92]Ibid, pp. 29-30.

[93]Ibid, pp. 34-35.

General technological advances

Research is currently being carried on for methods of directly converting chemical energy or heat to electric energy without the use of the large rotating machinery. The advantage here is in replacing relatively high friction-wear equipment and also removing one barrier to the use of higher temperatures in the process. At the present time a "magneto-hydrodynamic" generator appears to be the most promising of five separate types in the process.[94]

Major changes in fuel transportation are aiding the economical operation of electric utility plants, primarily in the coal industry. Transportation costs are often equal to the at-mine costs of the coal. New methods in transportation through fixed-train use, and the same concept applied to large fixed-barge carriers, reduce the costs. The extra high voltage lines have also made possible "mine-mouth" stations. This is the building of a generating plant right at the mouth of a mine reducing coal transportation costs drastically. Since approximately 2/3 of thermal-electric energy is produced by coal-burning plants any savings here is important to the industry.

Nuclear power

The electric utility system's nuclear-fueled plants generated 1.7 billion kilowatt hours in 1961 and 2.3 billion in 1962. This is only .2% and .3% respectively of the total kilowatt hours produced in 1961 and 1962. During fiscal 1963, eight nuclear generating plants were placed in production in

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[94]Ibid, pp. 34-35.

the United States. These eight plants have a total capacity of 400,000 kilowatts. Nuclear plants in construction at this time (June, 1963) totaled approximately 650,000 kilowatts additional capacity. A large number of "civilian" nuclear reactors are currently planned, primarily in areas where fuel costs are comparatively higher. That will add 3.5 million kilowatts of capacity to the nuclear total.

Forecasts by the Federal Power Commission estimate a nuclear generating capacity of 40 million kilowatts by 1980, however, this is only 7% of the total electric generating capacity estimated for that same year. For the near future there is no expected large trend in replacement of conventional type generation by nuclear but as costs of nuclear plants are reduced to become more competitive its use will increase. The Federal Power Commission does say that, "For the longer term future, present indications are that nuclear power will become an increasingly important part of the future."[95]

Hydroelectric power

The production of hydroelectric plants in 1962 was 168.1 billion kilowatt hours, 19.74% of the total electricity produced. Applications filed with the Federal Power Commission for licenses covering a total of 3,516,000 kilowatts of new capacity of 12,320,000 kilowatts in hydroelectric projects.[96]

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[95]Ibid, pp. 31-32.

[96]Ibid, p. 79.

The Federal Power Commission maintains an inventory of hydroelectric sites of the nation both developed and undeveloped. As of January 1, 1963, these resources were estimated at 154 million kilowatts of generating capacity and are considered capable of producing 644 billion kilowatt hours of electric energy a year. These capacities and total estimates are revised often, mainly because of the changes in capacity of planned installations or improved techniques of engineering and power generation.

With about 38 million kilowatts of generating capacity in existence now it is apparent that our national water sites hold a tremendous potential reserve of generating capacity. Less than 25% of the total now being used and that percentage at levels of existing technology. With future advances this percentage may become an even smaller part of the potential.[97]

Geo-thermal power

The Pacific Gas and Electric Company of California has a plant in operation using a source of steam to power its generating equipment which has intrigued geologists and engineers for years. At Geyserville, California, Pacific Gas is utilizing nature's own heat, expelled through geysers, generated from the center of the earth to produce electricity.

The plant built at a cost of $2 million produces 26,000 kilowatts, enough electricity for the requirements of a 40,000 population community. Wells were drilled in the

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[97]Ibid, pp. 83-87.

geyser region to a depth of 700 feet and pipelines from these wells gather the steam and transport it ¼ mile to the plant. The cost per kilowatt hour is 5.9 mills. Conventional power plants using fuel oil or natural gas have an average cost per kilowatt hour of 6.6 mills and nuclear powered plants 6.2 mills.

The plant was first opened in June, 1960, and was enlarged in December, 1962. Although its power generation accounts for only .4% of Pacific Gas and Electrics total volume of kilowatts it was proven successful and economically feasible.

This is the first plant of this nature in the western hemisphere but similar plants have been functioning in Italy and New Zealand for several years. Other geothermal sites are being developed at Casa Diablo Hot Springs and the Salton Sea in California and Eureka County, Nevada.

This type of generation will not compete on a large scale with other sources because of a shortage of appropriate sites. It is another application of man's search to provide new methods of electric generation.[98]

Although the nation's need for power will continue to grow in huge amounts our resources are not yet utilized anywhere near their potential. Research is constantly discovering improved and new methods and techniques for additional generation, and giant strides are being made in distributing developed generation over large distances by interconnection of power systems.

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[98]Seymour Korman, Use Earth's Steam to Produce Electrical Power in California, (Chicago Tribune, October 27, 1963).

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